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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Geun Sig Cha et al.
Serial No.: 09/818 750
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For : PLANAR REFERENCE ELECTRODE

Docket No.: 01-219
Examiner : TONG
Art Unit : 1743

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INFORMATION DISCLOSURE STATEMENT

11033 U.S. PTO
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Hon. Commissioner of Patents & Trademarks
United States Patent & Trademark Office
Washington, D.C. 20231

Dear Sir:

In accordance with the requirements of 37 CFR 1.97 and 1.98, Applicants hereby submit the prior art listed hereinbelow, copies enclosed.

(1) U.S. Patent No. 4,933,048, entitled REFERENCE ELECTRODE, METHOD OF MAKING AND METHOD OF USING SAME, By Imants R. Lauks, patented June 12, 1990. This patent discloses an improved reference electrode for use in potentiometric measurements of the amount of ions in an aqueous solution. The reference electrode illustratively comprises a metal member on a substrate, and a layer of a salt reversible to the ion X overlying the metal member. The reference electrode is overlaid by a quantity of an electrolyte, which may be a polymer

gel having a salt including the ion X dispersed therein. This structure is overlaid by a membrane permeable to water but not to the ion X that extends beyond the portion of the electrolyte overlying the electrode, but leaves a portion of the electrolyte exposed. This assembly may be shipped dry. In use, when the electrode is disposed in an aqueous solution containing an ionic species to be measured, water permeates the membrane and "wets up" the electrolyte relatively quickly. Any changes in ionic concentration, however, have to be made over a substantially longer path through the electrolyte between the electrode and the exposed portion such that the transit time for such changes is substantially longer than the wet-up time of the electrolyte. This reference electrode may be used in combination with a wide variety of potentiometric indicating electrodes or other structures.

(2) An article entitled MINIATURIZED REFERENCE ELECTRODE BASED ON A PERCHLORATE-SELECTIVE FIELD EFFECT TRANSISTOR, By Wilhelm Potter et al., published by Analytical Chemistry, Vol. 67, No. 24, December 15, 1995, pp. 4586-4588. This article discloses a new type

of reference field effect transistor (REFET) based on a perchlorate-selective field effect transistor. The top of the ion-selective layer is coated with another layer containing solid potassium perchlorate. Potassium perchlorate is not readily soluble in aqueous solutions; therefore, the perchlorate activity in the aqueous surface layer is equal to that of a saturated solution. The constant activity leads to a constant potential of the REFET. The stability of this REFET potential was examined in solutions of different salt concentrations and different pH values. The influence of the pH value on the REFET potential was compared to that of a commercially available Ag/AgCl electrode. According to this comparison, the perchlorate reference electrode proved to be very well suited for an integration on an ISFET chip.

(3) An article entitled THICK FILM SILVER-SILVER CHLORIDE REFERENCE ELECTRODES, By A.W.J. Cranny et al., published by Meas. Sci. Technol. 9 (1998) pp. 1557-1565. Printed in the UK. This article discloses the fabrication of prototype thick film silver-silver chloride electrochemical reference electrodes. Combinations of commercially available and proprietary

thick film pastes have been used in their construction in a multi-layer planar configuration modelled upon the structure of the classic single junction silver-silver chloride reference electrode cell. Several variations in the basic electrode design were fabricated, involving combinations of one of three different paste formulations for the silver-silver chloride layer coupled with one of two combinations of paste formulation for the salt containment matrix. The relative performances of these different versions of reference electrode were evaluated in terms of their chloride ion sensitivity, hydration times required to achieve a stable potential and usable lifetime. It is shown that, depending on the processing methodology employed at certain stages in the fabrication of these devices, a large degree of variation in characteristics can be achieved and therefore exploited in the design of reference electrodes suitable for a range of specific applications.

(4) An article entitled PROMISING NEW SOLID-STATE REFERENCE ELECTRODE, By K. Nagy et al., published by J. electrochem. Soc., Vol. 144, No. 1, January 1997. This article discloses a solid-state reference electrode

which has been constructed and tested. Experiments have shown that the reference electrode gives a negligible and constant contribution to the measured EMF. The solid-state reference electrode was used as a reference electrode for an Orion Fluride (F^-) selective electrode. This cell behaves satisfactorily compared to an Orion F^--combination electrode. The first promising progress has therefore been made toward realization of a new solid-state reference electrode.

(5) An article entitled DISPOSABLE REFERENCE ELECTRODE, By A. Mroz et al., published by Analyst, June 1998, Vol. 123 pp.1373-1376. This article discloses a disposable reference electrode which was developed which can be used for environmental and medical analysis. It is an Ag/AgCl electrode with an integrated junction, prepared using inexpensive materials such as glass-fibre filter medium and heat-sealing film with screen printing and encapsulating by lamination. The potential difference between this electrode and a commercial electrode is hardly influenced by concentration changes and pH (3-11) of the analyte solution. The shelf-life and the operational lifetime of the reference electrode were investigated. Applications with disposable ion

selective sensors are demonstrated.

(6) An article entitled DEVELOPMENT OF THIN-FILM LIQUID-JUNCTION AG/AGCL REFERENCE ELECTRODES AND THEIR APPLICATIONS TO ONE-CHIP MICRO CHEMICAL SENSORS, By H. Suzuki et al., published by Transducers 1999 June 7-10, pp. 1180-1183. This article discloses fabricating one-chip potentiometric sensors or integrating such sensors in a microsystem, a reliable miniature liquid-junction reference electrode is a prerequisite. In realizing such a liquid-junction reference electrode, the most troublesome issue has been the development of a durable thin-film Ag/AgCl element. Fabricated durable elements which functioned even in a solution saturated with KCl. The entire surface of a silver layer was covered with a hydrophobic polymer layer and AgCl layer was grown either from the edges of the pattern or from a slit at the center. Compared with the currently-used structure, the lifetime was extended by more than two orders. The novel Ag/AgCl elements were applied to liquid-junction reference electrodes. By storing precipitated KCl as much as possible, one of the reference electrodes functioned more than 100 h. The liquid-junction reference electrodes were applied to

some one-chip chemical sensors including a pH sensor. Their response was virtually the same as that obtained using a macroscopic Ag/AgCl electrode.

The undersigned submits the above-identified references for independent consideration by the Examiner and does not make any admission that these references are or are not material to the present invention or that these references are or are not prior art with respect to the present invention.

I hereby certify that this correspondence is being deposited with the United States Postal Service as Express Mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231

on March 27, 2001
(Date of Deposit)
Rachel Piscitelli
Name and Reg. No. of Attorney
Rachel Piscitelli
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March 27, 2001
Date of Signature

Respectfully submitted,

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